The Effect of Firms' Phased Retirement Policies on the Labor Market Outcomes of Their Employees

Martin Huber, Michael Lechner, and Conny Wunsch*

[[Abstract]] In this article, the authors assess the impact of firms' offering a special form of phased retirement on their male employees' labor market outcomes. The program aims at smoothing the transition from work to retirement and at decreasing costs in the public pension and unemployment insurance schemes through an increase in employment of elderly workers who otherwise would have exited prematurely through unemployment or early retirement. In line with these objectives, the authors assess whether male employees spend more time in employment and less time in unemployment or inactivity after the introduction of the program. The analysis is based on unique linked employer-employee data that combine high-quality survey and administrative data. Results suggest that phased retirement options offered by firms can help to reduce some of the public costs of low labor force attachment of elderly workers, mainly by reducing exits through unemployment and by increasing employment and earnings. Under relatively good labor market conditions, however, they may also encourage a small share of workers to exit the labor market earlier.

Low labor market attachment of the elderly has far-reaching consequences for the sustainability of the public welfare system in general and the pension system in particular, as well as important implications for future labor supply in aging societies. Despite increasing longevity, the average effective age at which older workers withdraw from the labor force has declined in almost all OECD countries since the 1970s (OECD 2009). Even though this trend has slightly reversed since the turn of the millennium, the effective retirement ages in all but

* Martin Huber is [[Professor of Applied Econometrics]] at the Department of Economics, University of Fribourg. Michael Lechner is [[Professor of Econometrics]] at the University of St. Gallen, Swiss Institute for Empirical Economic Research. He is affiliated with CESIfo, Munich, and IZA, Bonn, as well as with CEPR PSI, London, and IAB, Nuremberg. Conny Wunsch is [[Professor of Labor Economics]] at the Department of Labour Economics, University of Basel. This project received financial support from the Institut für Arbeitsmarkt und Berufsforschung (IAB), Nuremberg (contract 8104), and from the St. Gallen Research Center for Aging, Welfare, and Labor Market Analysis (SCALA). We are grateful to the staff of the Forschungsdatenzentrum (FDZ) of the Federal Employment Office (BA) in Nuremberg, where the estimations were conducted, who provided kind and skillful assistance. Additional results and copies of computer programs used to generate the results presented in the article are available from the author(s) at [[michael.lechner@unisg.ch]].
Keywords: part-time work, elderly employees, treatment effects, matching

two OECD countries remain substantially lower than in the 1960s and 1970s. For Germany, which is the country we study, Börsch-Supan and Jürges (2011) reported that the labor force participation of elderly men aged 60 to 64 has dropped from more than 80% in 1966 to less than 35% in 1980s and 1990s. Since about the year 2000, the participation rate has been increasing again, arguably in response to a sequence of cost-cutting reforms after 1992, but it was still just over 40% in 2005. Also, female labor force participation in this age group dropped sharply in the 1970s and started to recover only in the mid-1990s, reaching approximately 25% in 2005.

An increasing number of studies show that elderly workers are quite responsive to the relative attractiveness of different pathways toward retirement such as early retirement options, unemployment insurance (UI), and disability insurance (e.g., Staubli 2011; Staubli and Zweimüller 2013; Inderbitzin, Staubli, and Zweimüller 2013). We contribute to this literature by studying a special set of phased retirement options for workers aged 55 and older that Germany introduced in 1996 under the name of *part-time work for elderly employees* (henceforth PWE). Using this scheme, employers and employees can agree to reduce working time by half by choosing one of two options: a part-time work schedule during the entire PWE period or a full-time work schedule in the first half and a leave of absence in the second half of the PWE period (the so-called block model). During the entire PWE period, employers have to pay at least 50% of the gross wage. In our study period Germany's Federal Employment Agency (FEA) actively encouraged the use of PWE by providing a supplement payment if workers leaving the firm through PWE were replaced with unemployed or young job seekers.

The objective of PWE is twofold. First, it aims at smoothing the transition from work to retirement by offering the option of gradual or early withdrawal from the labor market.[1]

[1] Indeed, multiple surveys that have been conducted in various countries suggest that workers have an interest in reducing their working hours as they get older; see, for instance Abraham and Houseman (2004) and Drago, Wooden, and Black (2009).

Second, the aim is to decrease costs in the public pension and unemployment insurance schemes through an increase in the labor force attachment of elderly workers who otherwise would have withdrawn from work life completely through unemployment or early retirement. The political discussion of PWE has been highly controversial. Critics argue that the block model, which accounts for the vast majority of PWE agreements, is similar to "regular" early retirement schemes and encourages early exit (see the discussion in Brussig, Knuth, and Wojtkowski 2009), thus, in contrast to its initial intention, creating unjustifiable public costs through the supplement payments of the FEA.

Motivated by the challenges of the negative effects of low labor market attachment of elderly workers in aging societies and the ambiguity of the merits of PWE in the political discussion, this article investigates the effects of the availability of PWE in German firms on the labor market outcomes of their male employees.[2] In line with the objectives of PWE, we assess whether since the introduction of PWE employees spend more time in employment and less time in unemployment or inactivity. Our findings can therefore serve as inputs to a cost-benefit analysis of PWE in terms of its public costs. Moreover, we analyze effect heterogeneity with respect to regions with different labor market conditions, as they may be important for the relative attractiveness of different potential pathways to retirement.

Most of the existing literature has focused on studying the determinants of phased retirement (e.g., Gustman and Steinmeier 1984; Honig and Hanoch 1985; Ruhm 1990; Hurd and McGarry 1993; Haider and Loughra 2001; Hutchens 2003; Even and Macpherson 2004; Hutchens and Grace-Martin 2006; Hutchens and Chen 2007; Robinson and Clark 2010). Comparatively few studies have investigated the effect of these schemes on exit strategies of

[2] Note that the main text focuses on the results for males only because of econometric issues in the female sample that are outlined below in the Results section. The results for females are presented in the Internet appendix to this article at [[AU: Provide URL]].[[AU: Our publisher, SAGE Publications, can host the online material and make an active link in the online article that goes directly to the supplemental material. If you would like to make use of that service, I'll add the website URL; if you would prefer to host the material on another website you have access to, that's fine too—just let me know what that website address is. ANSWER FROM AU: The online material should be hosted by the publisher – thank you very much!]]

older workers. Using the 2006 Portuguese Labour Force Survey and a hazard model, Machado and Portela (2012), for example, investigated the effect of a voluntary reduction in hours of work on the timing of full retirement. The authors found that reductions are associated with earlier retirement in their data and concluded that reducing hours of work appears to signal the desire to retire sooner rather than to remain in the labor market (at reduced hours).

Relative to the existing literature, we also make some methodological improvements. We exploit unique linked employer-employee data that combine high-quality survey and administrative data. These data allow us to follow individual labor market outcomes for up to 6.5 years, such that both short- and longer-term effects can be assessed. Moreover, we use robust and relatively flexible semi-parametric econometric methods, which, in contrast to parametric estimators, do not rely on tight functional form assumptions likely to be violated in applications, and they allow for effect heterogeneity. Last, we explicitly address the selection problems involved in the estimation of the effects of PWE on workers' labor market outcomes. We eliminate the potential problem that workers may self-select into firms offering PWE by focusing on firms that did not offer PWE by the middle of the year 2000 and by excluding workers who entered the firm less than three years prior to this time. Then, by conditioning on a rich set of firm, worker, and regional characteristics coming from various combined data sources, we account for the fact that some establishments introduced PWE between 2000 and 2002, while others did not. Finally, we exploit the panel structure of the data and take out time-constant unobserved factors as well as differential trends that may determine workers' labor market outcomes or firms' performance. Estimating the effects for a group of workers that should be unaffected by the introduction of PWE serves as a placebo test that supports our empirical strategy.

[[AU: This paragraph is very similar to the concluding one on page 30. Is that intentional and okay? ANSWER: Yes, is ok from our side.]]Our results suggest that phased

retirement options offered by firms can help to reduce some of the public costs of low labor force attachment of older workers, mainly by reducing exits through unemployment. For the majority of workers, we find that the introduction of PWE increases employment and labor earnings and reduces unemployment of older workers, while leaving the time of complete withdrawal from the labor market unchanged. Hence, it benefits the government budget in terms of increased tax revenue and social insurance contributions as well as reduced unemployment insurance payments. A rough cost-benefit analysis suggests average net savings in public costs per worker in PWE of about 3,000 to 4,500 euros in West Germany and 4,500 to 7,000 euros in East Germany (depending on the assumptions about discounting). Under relatively good labor market conditions, however, there may also be some undesired effects. We find evidence that the availability of PWE encourages some workers to exit the labor market earlier than they would in the absence of PWE.

The remainder of the article is organized as follows. The next section provides background information on PWE in Germany. In the following section we describe our empirical strategy. After that we present descriptive statistics and balancing tests, followed by a discussion of the results. The final section concludes. An online appendix, available at [[AU: URL?]], provides further descriptive statistics and estimation results for both males and females.[[AU: This "previewing" paragraph isn't necessary because the subheadings will guide readers through the material. Okay to delete? ANSWER: OK to delete, if this is what the journal prefers to do.]]

<H1>Background Information on Part-Time Employment for the Elderly in Germany

<H2>Institutional Background

Minimum legal standards for phased retirement agreements were introduced in Germany in 1996.[3] These agreements can be used for workers aged 55 or older. There is no legal

[3] Altersteilzeitgesetz (PWE Act).

requirement that employers provide PWE. The adoption of PWE is conditional on the employer's decision to offer these options and formally requires consideration in the collective wage agreement (if applicable) or some form of internal agreement (Brussig et al. 2009). Employees and employers can agree to reduce working time by half, choosing one of two options: a part-time work schedule during the entire PWE period or the so-called block model that comprises a full-time work schedule in the first half and a leave of absence in the second half. Corresponding to the reduction of working hours by half, employers have to pay at least 50% of the gross wage during the entire PWE period, but several collective wage agreements provide for higher wages, the average payment being 73% (S. Wanger 2009).

During our observation period, Germany's Federal Employment Agency actively encouraged the use of PWE by providing a supplement payment if workers leaving the firm through PWE were replaced with unemployed workers or young job seekers.[4] The supplement was granted for at most six years, even if the PWE agreement covered a longer period. The payment was a top-up of the employer's payment by 20% of the pre-PWE gross salary, including single or irregular payments. Moreover, the FEA paid 90% of the worker's compulsory pension contributions. The FEA subsidies were abolished at the end of 2009.

<H2>Utilization of PWE

As shown in Figure 1,[[Figure 1—given that the Journal style doesn't number the subheadings/sections, we will renumber the figures and tables sequentially throughout the article]] the utilization of PWE increased steadily in the 10 years after its introduction in 1996, reaching an annual average total of almost 530,000 employees in 2006. In the subsequent two years, PWE utilization remained quite stable. Almost one-fifth of employees subject to obligatory social security contributions aged 55 to 64 were in PWE in 2007 (Brussig et al. 2009). In 2009, PWE experienced a sharp rise to more than 672,000 workers. This rise likely reflected a reaction to the great economic crisis or the anticipation of the

[4] Smaller companies with up to 50 employees also received the subsidy if they hired apprentices.

abolishment of the FEA subsidies. In our observation period (2000–2008), the average age at which workers entered PWE was 57 for females and 58 for males. The average duration in PWE increased from three years in the early 2000s to somewhat more than four years at the end of the decade (S. Wanger 2009).[5]

[[Figure 1 (Renumbered as Figure 1 and will continue numbering sequentially) near here]]

Interestingly, only 15 to 20% of total PWE in any given period was supported by the FEA, suggesting that many employers, though they adopted PWE, preferred forgoing the FEA supplement payments at the benefit of remaining unconstrained in their hiring policies. After a continuous rise, the number of beneficiaries passed 100,000 in 2006 and has been declining slowly ever since 2008.[6] The costs of FEA sponsoring were nevertheless far from negligible. Expenditures increased substantially after the PWE Act came into force, therefore causing much controversy in political and public debates in Germany. They climbed from just 10.6 million euros in 1997 for 3,286 cases to a staggering 1.38 billion in 2007 when FEA-sponsored PWE reached its peak (104,350 cases).

Disentangling the two PWE models—namely, part-time work over the entire time frame versus the block model—reveals that the latter is by far the more popular option and has become more important over time. Already in 2005, 84.6% of all FEA-sponsored PWE agreements were based on the block model, and its share increased to 89.1% in 2008 and 90.2% in 2011 (German Federal Employment Agency 2012). The predominance of the block model seems to be contrary to the initial political intention to truly smooth the work-retirement transition rather than have separate periods of full and no employment. S. Wanger

[5] Note that workers in PWE (or unemployed) have early access to regular retirement at the ages of 60 to 63 (depending on their year of birth). Their retirement benefits will, however, be reduced to some extent because they left before the regular retirement age.

[6] Note that this number considers only cases that received FEA transfers in the respective year, irrespective of the total time frame of the PWE agreement. For the block model, this implies that the individuals enter these statistics only during their leave of absence, that is in the second half of the PWE, as FEA payments start only after the full-time work phase.

(2009) noted, though, that it was both the employer and the employee organizations that demanded the introduction of the block model in the PWE Act. Arguably, it provides employers with a socially acceptable means to adjust their workforce and enables employees to retire early without large financial losses, which explains the popularity of PWE.

<H2>Interactions with Other Retirement Options

As in most countries, in Germany there exist different options for leaving the labor market before statutory retirement age. In the following we discuss the most important ones because they affect the relative attractiveness of PWE. First, workers could retire [[AU: Should discussion of these options be in the present tense since first sentence suggests they are still available? ANSWER: Yes]]early at age 60[7] before statutory retirement age (65 for most workers in our observation period)[8] under certain circumstances: 1) out of unemployment if they had been unemployed for at least 12 months after turning 58.5 years old, 2) out of PWE if they had spent at least 24 months in PWE, or 3) if they had contributed to the pension system for at least 35 years. Early retirement via unemployment or PWE, however, leads [[AU: Note present tense]]to penalties on the final pension of 0.3% for each month of retirement before statutory retirement age. As a consequence, it is attractive to use unemployment or PWE to be able to exit the labor market early and to use it for as long as possible in order to minimize pension penalties.

Second, workers could leave [[AU: See query above—present tense? ANSWER: Yes]]the labor market through unemployment covered by unemployment insurance payments. Workers aged 55 or older with sufficiently long work histories were eligible for 18 to 32 months of UI during our observation period (2000–2008). The time on UI counts as a

[7] For male workers born in 1946 to 1948, the early retirement age increased by one month for each month born after 1945 until it reached 63 for cohorts born in 1949 to 1951. Early retirement options 1 and 2 were abolished for cohorts born in 1952 or later.

[8] For females, the statutory retirement age was 60 for cohorts born before 1940. Thereafter, it was gradually increased by one month for each month born later until it also reached 65 for cohorts born in 1945 or later. Moreover, for cohorts born in 1947 or later the statutory retirement age has been increased gradually to 67 for cohorts born in 1964 or later.

contribution period for the calculation of the pensions, although with a considerably lower value than regular employment. At 60% of the previous average after-tax salary, the UI replacement rate is usually comparable to the replacement rate of statutory pensions, thus providing strong incentives to use up UI before retiring early (with penalties on the statutory pension) or to use UI from an age at which it completely covers the time until statutory retirement age. Compared with UI, PWE has several advantages. First, it covers a considerably longer period than UI (on average three to four years). Second, it provides higher income—on average 73% of the previous gross salary (S. Wanger 2009). Finally, it counts as a contribution period for the calculation of pensions with a higher value than UI. Hence, from an individual perspective, PWE is the most attractive option for those who leave the labor market before statutory retirement age, followed by exit through UI and standard early retirement.

<H1>Empirical Strategy

<H2>Parameter of Interest and Basic Idea

We are interested in the effects of a firm's offering PWE compared with not offering PWE on the labor market outcomes of the firm's employees. Specifically, we estimate the effect of the *introduction* of PWE in a firm rather than the *use* of PWE by its employees. Hence, we estimate a causal parameter similar to an intention-to-treat effect. By doing so, we avoid having to solve the selection problem associated with individual use of PWE, which would require more information than is available in our data.[9] Moreover, the effect of introducing PWE at the firm level is interesting per se because this is the only thing that firms can influence directly. We focus on the so-called average treatment effect (ATE) of introducing PWE

[9] Mainly on the basis of U.S. data, Gustman and Steinmeier (1984); Honig and Hanoch (1985); Ruhm (1990); Haider and Loughran (2001); Kim and DeVaney (2005); and Robinson and Clark (2010) identified the following determinants of utilization of phased retirement options: age, health, family status, pension coverage, mandatory retirement provisions, wages, education, expected social security income, nonwage income, self-employment, and labor force experience. Many of these variables, especially health and pension coverage as well as family status and self-employment, are unobserved in our data.

compared with not introducing it. This corresponds to the effect for an employee randomly drawn from our estimation sample.[10]

To disentangle the effects of the introduction of PWE by employers from other determinants of the worker's labor market outcomes, two selection problems remain. First, workers may self-select into firms that offer PWE. We solve this problem by focusing on firms that did not offer PWE in mid-2000 and by considering only workers who had been with the firm for at least three years by mid-2000. Hence, all workers included in the analysis joined their firms at a time when they did not offer PWE and when it was not foreseeable that they might offer PWE in the future. The second selection problem arises because firms selectively rather than randomly introduced PWE between mid-2000 and mid-2002. To solve this problem, we first exploit exceptionally informative linked employer-employee data using matching techniques. Second, we exploit the panel structure of the data and take out time-constant unobserved factors as well as differential trends that may determine firm performance or workers' labor market outcomes.

<H2>Data

Our empirical analysis relies on unique linked employer-employee data that combine different administrative and survey data from the Federal Employment Agency's Institute of Employment Research (IAB). The data come from the IAB Establishment Panel (IAB-EP), which is a representative survey of German establishments[11] and covers a broad spectrum of firm-level information. The survey was first conducted in 1993 and is annually repeated. It is an unbalanced panel as a result of attrition and the inclusion of new companies over time.

The information from the IAB-EP was merged with that from the so-called IAB Establishment History Panel, which includes a rich set of aggregate information on the firm's

[10] Our empirical strategy also allows estimating effects for the group of (non)treated employees, that is, for those actually working in establishments with or without PWE. They are available from the authors upon request. In general, they are comparable but considerably less precisely estimated.
[11] An establishment either is a single firm or comprises all branches of a larger firm within the same relatively narrowly defined region and industry. In the following, we will use the terms "establishment" and "firm" interchangeably.

employees. This information is based on the employees' social insurance records and is constructed, for each year, from the cross section of all workers employed in the firm on June 30. It describes the size and the composition of a firm's workforce—for example, in terms of age, education, tenure, and earnings—as well as the flows of workers into and out of the firm from one year to the next.

For the firms in our sample, which are described in more detail below, the social insurance records of their employees for the years 1990 to 2008 have been merged with the firm data. They comprise full employment, unemployment, and earnings histories, as well as a rich set of personal characteristics for all workers employed by the firms in our data on June 30, 2000.[12] Finally, the data also contain a rich set of regional characteristics such as the federal state, urbanization, and local labor market conditions, which have been merged by means of county identifiers from regional statistics.

<H2>Definition and Measurement of the Treatment

For identification, we focus on estimating the effects of the introduction of PWE between 2000 and 2002. Information about PWE comes from two sources. First, the 1999 and 2002 waves of the firm survey include a question as to whether the firm offers PWE. Second, the social insurance records of the employees indicate whether there is any worker on a PWE contract. Our baseline sample consists of firms that did not offer PWE in 1999 and 2000 (measured in the 1999 survey and the administrative data from 1999 and 2000).

"Treatment" status is defined on the basis of the availability of PWE in 2002: The treated pool consists of all firms that have switched to offering PWE (according to the survey data), while those not offering PWE in 2002 (according to both the survey data and the administrative data) constitute the nontreated sample. The very few firms for which PWE is

[12] The social insurance records were also used, for example, by Wunsch and Lechner (2008), Biewen, Fitzenberger, Osikominu, and Paul (2014), Wunsch (2013), and Lechner and Wunsch (2013) but with a different sampling design.

offered according to the administrative data but not according to the survey data are discarded.

We do not distinguish between the two types of PWE—the block model and the part-time model—as we did not observe this distinction in the data. Workers in both models remain registered as employed in the firm for the full PWE period. In particular, workers in the block model remain registered as employed during their leave of absence. Hence, both types of workers look the same in that respect in our data. Moreover, as pointed out above, the vast majority of workers choose the block model (85–90%). Thus the treatment we consider is dominated by the block model.

<H2>Sample Selection

Our empirical analysis is based on a subsample of the establishments included in the IAB-EP in 2000. For this project, we had access to a linked employer-employee data set that covers 2,980 of the 13,931 establishments in the 2000 wave of the IAB-EP. Excluded are establishments with fewer than 100 employees (about 72% of the total sample), the 25 largest firms, and firms in the agriculture, foresting, mining, energy, transportation, messaging, education, and social insurance sectors (about 20% of the total sample).[13] Thus the sample is restricted to private companies that are representative for firms in the manufacturing and service sectors.[14] For the firms in this sample, we observe the administrative records of about 1.4 million workers employed by these firms in June 2000.

In the following, we describe how we selected firms and workers from this sample in order to ensure identification of the effect of introducing PWE. The effects on sample size and sample composition are documented in Table A.1 in Appendix A and discussed below. In what follows we focus on males only, while the descriptive statistics and estimation results

[13] The percentages provided here and below refer to the original sample of 13,931 firms. Hence several firms satisfy multiple sample restriction criteria.

[14] This article is part of a larger cooperation project with the IAB that focused on intra-firm comparisons of workers in the private manufacturing and service sectors. The former required a sufficiently large number of employees per firm. For the latter, sectors with large public shares in the past [[AU: Unclear]]were excluded as well.

for females are presented in the Internet appendix.[[AU: Provide Internet address in a footnote. ANSWER: Pls do so.]] This is due to econometric issues in the female sample that are outlined in detail below.

First, to measure the treatment we need to observe firms in the 1999 and 2002 waves of the survey (see the preceding subsection). Because of relatively high attrition rates in the IAB-EP and a small amount of item nonresponse in the relevant question about PWE, the original worker-firm sample is reduced by 28%. The sample composition remains very similar, however, suggesting that attrition is nonsystematic. Second, as we focus on estimating the effects of the introduction of PWE after 2000, our sample consists only of firms that did not offer PWE in 1999 and 2000, which reduces the worker-firm sample by another 85%. At this stage, selectivity in the introduction of PWE by firms becomes visible: Firms using PWE already in the baseline period are larger on average than nonusers and are concentrated in the service sector with relatively high shares of clerks and workers in higher-skilled occupations. In line with this, average earnings in the remaining firms are also lower. Other than that, however, the sample composition is again very similar to that in the original sample.

Third, as regards the workers in our sample, we consider only workers aged 31 to 60 (in June 2000). This condition ensures that workers are sufficiently distant from educational choices and statutory retirement age (65). Moreover, as mentioned above, we exclude workers with less than three years of tenure in June 2000. This ensures that the workers we study did not self-select into firms that offer PWE because they joined the firms at a time when the firms did not offer and it was not foreseeable that they would offer PWE. Additionally, we exclude a small number of West German workers who had not been employed for all of the last 10 years before June 2000. This is done to ensure common support between firms with and without PWE, as this variable almost perfectly predicts whether firms offer PWE. Therefore, firms with and without PWE cannot be made comparable with respect to this

characteristic. In total, the three criteria together reduce the sample by 44%. In terms of sample composition, this (by construction) increases the average age of workers and in line with that, average earnings and the share of workers in the manufacturing sector.[15] It also increases (again by construction because of higher average tenure and the restriction on employment histories for West German workers) the average fraction of time employed in the last 10 years. Otherwise, the sample composition is again similar.

Again to avoid common support problems, we exclude firms with more than 1,000 employees in the year 2000, East German firms in the construction sector, and firms that neither have a collective wage agreement nor tie pay to collective agreements, as these characteristics almost perfectly predict whether firms offer PWE. Because we exclude large firms, this reduces the number of workers by another 54%. Except for average firm size, however, the composition of the sample is largely unaffected.

In summary, because of the selection steps we impose for the sake of identification, the effects we estimate generalize to the average worker and firm in the linked employer-employee data in many but not all dimensions: Firms in the estimation sample are smaller, more concentrated in the manufacturing sector, and less concentrated in service sectors that use more skilled labor. Workers in the relevant age group have larger average tenure and therefore somewhat more favorable employment histories as well as somewhat higher average skill and education levels but are less concentrated in clerks because of the differences in firms' sectors. This is important to keep in mind for the interpretation of our results.

We conduct our evaluation within six distinct strata. The resulting sample sizes of firms and (male) workers for each stratum and treatment are displayed in Table 1. We distinguish between East and West Germany because the incentives of firms to offer PWE might differ according to distinct labor market conditions in these two regions. In particular,

[15] Because of the structural change from the manufacturing to the service sector taking place in Germany and most other industrialized countries, older workers are concentrated in the former while younger workers, an over-proportional share of whom we exclude, are concentrated in the latter.

the labor market conditions in West Germany are much more favorable than those in East Germany. As we show in the section below on descriptive statistics, the firms operating in the two markets are different, which implies that selection into PWE might be distinct. By estimating the effects separately for the two regions, we allow for maximum flexibility in the selection correction part of the estimation. On the other hand, labor market conditions affect earnings and unemployment insurance claims, which in turn may influence the relative attractiveness of different pathways toward retirement. Hence there is also reason to believe that the effects of offering PWE might differ between East and West Germany.

[[Table 1 (Table 1, and continue to number sequentially) near here]]

Furthermore, we split the sample into three age groups (31–40, 41–50, and 51–60). As eligibility for PWE starts at age 55, direct effects of PWE should be visible in the oldest group, aged 51 to 60. We also include 51- to 54-year-olds because all of them became eligible for PWE during the 6.5-year period for which we measure outcomes. Moreover, focusing on 55- to 60-year-olds would almost halve the sample size of the most relevant group, thus leading to imprecise estimates. The intermediate age group (41–50) mainly serves to measure potential spillover effects on workers who are not yet eligible[16] but are sufficiently close to the ages at which early retirement decisions become relevant. For example, firms that introduce PWE may be more attractive to these middle-aged workers, who may increase tenure with the firm. The youngest age group (31–40) allows us to validate our identification strategy because it should be unaffected by the introduction of PWE. These workers are too young for early retirement decisions to become relevant. Moreover, because we require for identification that all workers in our sample be already employed in the firm prior to the introduction of PWE, they cannot be affected by the hiring of replacements for workers who leave the firm through PWE.

[16] Only a negligible fraction of this age group becomes eligible for PWE toward the end of the 6.5-year posttreatment observation period (see also Figure 2).

<H2>Outcome Variables

The individual administrative records allow computing a large number of outcome variables that measure different dimensions of employees' labor market performance for 6.5 years from July 2002 to December 2008. With the exception of tenure, they are measured in the second half[17] of June or December of a given year in two different ways: as binary labor market status indicators or income measures for that particular period (so-called point-in-time estimates) and as months in a given labor market status or income from a given source accumulated since July 2002 (so-called cumulated effects). We present the results for selected outcomes that seem to be most interesting. We start by investigating the use of PWE by employees to assess whether it is used in any quantitatively important way such that effects can be expected. We then analyze various individual labor market outcomes. First and in line with the main objective of introducing PWE, we investigate whether PWE increases the labor market attachment of older workers by increasing employment. Second, we assess potential public cost savings in terms of higher tax revenue and social insurance contributions by looking at labor earnings. Third, we investigate the effects on the time spent in unemployment. On the one hand, this provides information about potential savings in unemployment insurance payments. On the other hand, it is informative about exits from the labor market through unemployment. The reason is that only 11% of East German workers and 10.4% of West German workers in the oldest age group who enter unemployment in the 6.5 years for which we observe outcomes are employed at the end of the observation window, which is beyond or close to statutory retirement age for most workers in this group. Fourth, we investigate whether PWE reduces or increases the total time spent out of the labor force, which is informative about whether PWE leads to delayed exits from the labor market or encourages early exits, as found by Machado and Portela (2012). This is because only 9% of East German workers and 12% of West German workers who enter inactivity in the 6.5-year

[17] To determine a unique labor market status for each period, the administrative records have been arranged as a panel data set with one observation for each half of a month in the period 1990 to 2008.

outcome period are employed at the end of the observation window. Finally, we complete the picture by assessing potential returns to the firms directly: we analyze whether workers spend a longer time in the firms that offer PWE by looking at the effects on tenure.

Given that we address self-selection by workers into firms by focusing on workers with sufficiently long pretreatment tenure, the following discussion focuses on the issue of selective introduction of PWE by firms. Theoretical considerations suggest that firms' decisions to introduce PWE should be both employer- and employee-driven. On the one hand, PWE should be attractive for employers that want to downsize, rejuvenate, or otherwise restructure their workforce because the only alternative would be to lay off workers. This, however, would be very costly, especially for older employees with long tenure because these workers are protected by long notification periods and eligibility for generous severance payments. Moreover, German law makes it difficult to lay off workers for economic reasons. Even in cases for which this is possible, workers with short tenure and young workers without children must be laid off first. Whether firms want to downsize or restructure their workforce should be related to the economic conditions in the region and the industry of the firm, to firm size as well as to firm performance. Moreover, firms with physically more demanding jobs and a larger share of older workers should be more likely to offer PWE. The same is true for firms with a high incidence of health problems in their workforce because this is strongly correlated with age. Furthermore, it is easier for larger firms to accommodate PWE because they are more flexible in terms of the ability to offer part-time work and job sharing. Finally, because costs of corporate pension plans are more dependent on tenure than on individual salaries, employers may be less likely to introduce PWE if they offer such plans, depending on their tenure structure. From the employees' perspective, introduction of PWE is always desirable as it is the most attractive option for an employee who decides to leave the labor market before statutory retirement age. Hence it is more likely if there is strong worker representation in the firm—for example, through union coverage or a works council, which is

more likely the larger the firm is. Moreover, physically more demanding jobs and a larger share of older workers also raise interest in introducing PWE from the workers' point of view. Local labor market conditions also affect the attractiveness of PWE because being laid off might be the alternative. Last, workers may be more interested in PWE if they have accumulated sufficient financial means to be able to afford reductions of working hours or early exit from the labor market.

Several empirical studies confirm the importance of these factors. Hutchens and Grace-Martin (2006) concluded on the basis of the U.S. Health and Retirement Study (HRS) that phased retirement is more likely available in firms with flexible work hours, part-time employment, and job sharing.[18] This is in line with Hurd and McGarry (1993), who found that particular job characteristics such as the flexibility to reduce hours or move to a less demanding job increase the prospective retirement age.[19] Again using the HRS, Even and Macpherson (2004) considered both firm- and individual-level selection into phased retirement. Their results suggest that firms providing pension plans are less willing to allow workers to cut hours and that (in line with the studies mentioned above) pension-covered workers are less likely to switch to part-time employment and more likely to switch to full retirement. The latter is true even conditional on the original employer's willingness to allow for a reduction in work hours as well as on various firm and worker characteristics. Hutchens and Chen (2007) combined the HRS with a representative U.S. employer survey conducted in 2001 and 2002 and confirmed previous findings that the opportunity of phased retirement depends on both employer and employee characteristics (e.g., whether the company is public or private, workers' age, defined benefit pension plans, and unionization). Furthermore, Hutchens (2003) found that firm size and growth, as well as the composition of the workforce

[18] See also Hutchens (2010), who used the same survey to investigate which types of employees have particularly good chances of being considered for phased retirement in firms offering it at all.
[19] Pensions and health care insurance are further important predictors of prospective retirement, in contrast to physical and mental job requirements.

in terms of age, gender, and tenure, is correlated with the likelihood of offering phased retirement.

Table 2 summarizes the factors identified above from the theoretical considerations and the empirical literature and indicates how we can capture them with our data. There is only one factor we cannot capture, namely, corporate pension plans. This is largely negligible, however, because in Germany the vast majority of pensions come from public pension insurance. With 6–8% for German females and 1–3% for men in East Germany, the share of recipients of corporate pension plans is extremely low during our observation period. Only for West German men is this share higher, with about 30% (BMAS 2012). Even for most of these workers, however, the largest share of retirement income comes from the public pension system (Börsch-Supan and Wilke 2004). Only in some occupations do corporate pensions play a somewhat more important role. For example, they are concentrated in industries such as banking and finance. Hence we capture this by including industry and occupations dummies. Furthermore, corporate pensions are highly correlated with tenure and earnings, and we observe both the distribution of tenure and earnings in the firm and workers' tenure and earnings directly. Hence we are able to capture important aspects of corporate pensions for the cases in which they might be somewhat more important.

[[Table 3.2 (Table 2) near here]]

Nevertheless, to address the issue of any potentially remaining unobserved factors and possible trends that differentially drive labor market outcomes of treated and untreated workers, we additionally exploit the panel structure of the data, which allows us to observe detailed pretreatment labor market outcomes for all workers in our sample. Specifically, we are able to condition on a variety of summary measures of the workers' labor market performance over the 10 years prior to treatment. Hence we can take out not only any time-constant unobserved factors (fixed effects) that drive labor market outcomes but also any

differential long-term trends because we can essentially equalize workers in terms of all kinds of dimensions of labor market performance over the 10 years prior to mid-2000. Moreover, note that we are also able to measure time trends in firm performance, which may differ between treated and untreated firms because we observe firm growth, changes in revenue, investments, and turnover. The exact specification we use for selection correction is described in the next section and summarized in the last column of Table 2.

Finally, as mentioned above, we use the youngest group of workers, aged 31 to 40, to validate the identification strategy. They should be unaffected by the introduction of PWE because they are sufficiently far away from ages at which early retirement decisions become relevant and because they were already employed in the firm prior to the introduction of PWE. Hence they should be unaffected by hiring replacements for workers who leave the firm through PWE. Consequently, estimating the effects of the introduction of PWE for younger workers provides a placebo-type test by which a negligible and insignificant effect supports our identification strategy.

<H2>Estimation

Any estimator that eliminates selection bias based on observed factors is built on the idea of comparing outcomes across units with and without treatment that are similar with respect to observed confounders in order to pin down the causal effect of the treatment. Instead of using parametric OLS, we use a propensity-score-matching estimator that defines similarity in terms of a function of the probability to be treated conditional on the confounders. In the program evaluation literature, this conditional probability is referred to as the propensity score (see Rosenbaum and Rubin 1983). An advantage of these estimators is that they are semi-parametric and therefore more robust than parametric methods like OLS and that they allow for flexible effect heterogeneity.

Among many possible matching estimators, we chose radius matching on the propensity score with regression adjustment as suggested in Lechner, Miquel, and Wunsch

(2011) to estimate the average effect of the introduction of PWE. This estimator has several attractive features. It is more precise than nearest neighbor matching (e.g., Dehejia and Wahba 2002). It remains consistent if either the matching step is based on a correctly specified propensity score model or the regression model is correctly specified (so-called double robustness property; see, e.g., Rubin 1979; Joffe, Have, Feldman, and Kimmel 2004). It reduces small sample as well as asymptotic biases of matching (Abadie and Imbens 2006), and it performs well in finite samples (Huber, Lechner, and Wunsch 2013) but without having to rely on functional form assumptions. The different steps involved in this particular estimator are described in Table E.1 in Appendix E.

The propensity scores needed for selection correction are estimated with separate probit models for each stratum. The dependent variable in each subsample is zero for workers in firms that do not offer PWE in 2002 and one otherwise. All probit models and their results are presented in Appendix B (men) and the online appendix (women). The specifications result from the identification issues discussed above as well as extensive specification tests for normality, heteroscedasticity, and in particular omitted variables. The data contain hundreds of variables, a lot of them being highly correlated. We started with a parsimonious specification that included the most important potential confounders according to the empirical literature and theoretical considerations summarized in Table 2. On the basis of omitted variables tests for all variables in the data, we sequentially added variables if suggested by the test statistics.

To capture the main incentives of firms to introduce PWE, the final specifications include firm size, industry, and the composition of the firm's workforce in terms of age and education, as well as several measures of restructuring activities, organizational factors, human resource policies, flexible work arrangements, and health problems within the firm. We also control for potentially differential trends for firms by including a measure of changes in firm performance. Local labor market conditions are measured using region dummies, local

unemployment rates, and rural/urban dummies. An indicator for pay's being tied to a collective wage agreement likely captures the strength of worker representation to a certain extent. Furthermore, we include age, foreigner status, education, occupation, tenure, and five measures of different dimensions of past labor market performance as individual determinants of labor market outcomes and to capture potentially unobserved individual factors as well as potentially different trends in labor market performance. Finally, current earnings and the sum of earnings accumulated in the last 10 years capture the financial situation of employees.

On the basis of the estimated propensity scores, we ensure overlap of the distributions of the covariates in the treated and nontreated samples by excluding treated individuals with scores higher than the maximum among the nontreated and, similarly, nontreated individuals with scores that are lower than the minimum among the treated. We document the loss of observations and the changes in the sample due to the impositionof common support in Tables C.1 and C.2 in Appendix C. For five out of six strata, we exclude fewer than 10% of workers, and for younger workers in East Germany we exclude 13%, in all cases with negligible effects on sample composition.

<H2>Inference

P-values for *t*-statistics to test whether the estimated effects are different from zero are obtained from a block bootstrap that resamples establishments (rather than individuals) along with all employees therein to account for clustering at the establishment level.[20] We use 499 bootstrap replications and compute the bootstrap *t*-statistics of the respective average effects in each of the samples (normalized by the estimated effect). We then estimate the *p*-value as

[20] Abadie and Imbens (2008) showed that for standard matching (based on a fixed number of comparison observations) bootstrap-based inference may be invalid. However, our matching algorithm is smoother than the one they studied because it uses a variable number of comparisons and a regression adjustment. For this reason, the bootstrap is most likely a valid inference procedure in our context.

the share of absolute bootstrap *t*-statistics that are larger than the absolute *t*-statistic in the original sample.[21]

<H1>Descriptive Statistics and Balancing Tests

This section presents descriptive statistics for the key group of elderly male workers (aged 51–60) and their employers. In Table 3,[[Table 3]] we present characteristics of the firms in which the elderly workers were employed in June 2000, separately by PWE status, gender, and region. Table 4[[Table 4]] displays the characteristics of male employees in those groups.[22] We report the mean characteristics by treatment status as well as their difference before and after matching. The latter shows how well our approach succeeds in eliminating selection bias, especially since most of the variables in the tables are not included in the estimation of the propensity score (see Table 2, and Appendix B).

[[Table 4.1 (Table 3) near here]]

Table 3 shows that the introduction of PWE is selective with respect to a range of firm characteristics. Establishments providing PWE on average perform better than those that do not: they are substantially larger, pay higher wages, and have increasing revenues and a higher rate of capital investments. Moreover, they differ considerably from non-providers of PWE in terms of the distribution of industries and organizational characteristics. Foreign-

[21] See, for instance, MacKinnon(2006) for a discussion of bootstrapping symmetric statistics. Since the theoretical results by Abadie and Imbens (2006) and the simulation-based results in Huber, Lechner, and Wunsch (2013) suggest that the estimator is asymptotically normally distributed, bootstrapping the potentially pivotal *t*-statistic (computed under the assumption that the weights obtained to compute the control group are non-stochastic) has the advantage of potentially providing so-called asymptotic refinements and thus improving inference. We also checked the bootstrap distribution of the estimated effects directly (quantile method). The results are similar (available on request).

[22] Information on the younger groups that are also considered in the econometric analysis (aged 41–50 and 31–40) is available from the authors on request. Also, because of the very large number of variables in the data (several hundred) we abstain from presenting statistics on all variables. They are available on request. The information available in administrative data is well documented in Wunsch and Lechner (2008) and Lechner and Wunsch (2013). For a detailed documentation of the variables available in the IAB Establishment Panel see Accessed at http://fdz.iab.de/de/FDZ_Establishment_Data/IAB_Establishment_Panel/IAB_Establishment_Panel_Working_Tools.aspx, for those in the IAB Establishment History Panel see http://fdz.iab.de/de/FDZ_Establishment_Data/Establishment_History_Panel/Establishment_History_Panel_Working_Tools.aspx ([[AU: approximate access date?]]. ANSWER: Pls see references).

owned firms or companies that tie wages to a collective agreement are less likely to offer PWE, while firms with profit-sharing arrangements are more likely to do so. The incidence of recent corporate reorganizations is also related to the treatment but in opposite directions for West and East Germany. A further important dimension concerns staff-related issues such as difficulties in hiring or retaining employees, because PWE could potentially be used to alleviate such problems. The data suggest that firms that report searching for employees and having trouble finding skilled personnel are more likely to offer PWE, arguably to prevent experienced elderly employees from leaving the firm too early. Interesting differences between East and West German firms underline the importance of looking separately at the two regions. The most pronounced differences occur with respect to average skill levels, turnover, and foreign ownership.

Table 4 shows the average characteristics of the employees aged 51 to 60 who are part of our estimation sample. The differences in earnings and occupations mirror those on the firm level displayed in Table 3. In all other dimensions, the differences between workers in firms that offer PWE and those that do not are rather small. Most important, the labor market performance of the firm's employees prior to the potential introduction of PWE is very similar and hence seems to be unrelated to this event. This suggests that by limiting our sample to workers with at least three years of tenure in the studied firms before potential treatment, we largely succeeded in eliminating bias due to self-selection of workers into firms.

[[Table 4.2 (Table 4) near here]]

Tables 3 and 4 also show that applying the matching estimator outlined above (on the common support) results in very satisfactory balancing of the covariate distributions across treated and untreated establishments. None of the differences in mean firm and worker characteristics is significant after matching. Moreover, for important firm characteristics with large differences before matching, balancing could be improved considerably—for example, for the sectorial distribution of firms as well as organizational and human resource factors.

Maybe most important, firm size, growth, and capital investments are well balanced after matching, ensuring that firms are not subject to differential trends in firm performance.

<H1>Results

In the following, we present only the results for men because the results for women failed the placebo test of the introduction of PWE on younger workers. The main explanation is a balancing problem that we cannot solve because of sample size issues. As evident from Table IA.3 in the Internet appendix, higher-skilled service occupations were strongly overrepresented among females in firms that offer PWE. Closer inspection revealed that this mainly concerns specific occupations in the health sector such as nurses and midwifes. Unfortunately, although there is very detailed three-digit occupation information in the data, we cannot include it in the probit estimation in sufficient detail to remove selection in that particular respect because of sample size issues. The alternative would be to exclude all women with occupations that we cannot balance. This, however, results in rather small sample sizes, which is why we decided to abstain from discussing the results for women altogether. They are available in the Internet appendix. Men present no such problems.[[AU: We can add a footnote here reminding authors what the website address is, once we have that info. ANSWER: YES]]

<*H2*>Utilization of PWE

The first question of interest is to what extent PWE is actually utilized if available in a firm. Figure 2 plots the estimated average effects of PWE availability on the cumulative utilization of PWE, separately for the three age groups. The effects are measured in months and half-yearly from mid-2002 to the end of 2008. As expected, none of the ineligible youngest workers use PWE. Moreover, workers aged 41 to 50 start to use PWE after four years when the first workers turn 55, but the total number is negligible, even at the end of the observation period (also see Table D.1 in Appendix D). This is in line with the fact that the average age of entering PWE is 58 (Wanger 2009). For the oldest age group, PWE use is statistically

significant on the 5% level at any point in time, as indicated by the superimposed round dots on the lines that represent the effects. About 6% of this age group use PWE (see Table D.1 in Appendix D), which results in the accumulation of on average of about 9 months of PWE over the 6.5-year posttreatment observation period.

[[Figure 5.1 (Figure 2) near here]]

<H2>Labor Market Outcomes

Figures 3 to 6 show the cumulated effects for different labor market outcomes in a fashion similar to that in Figure 2. The point-in-time estimates are reported in Table D.1 in Appendix D. First, we investigate whether PWE increases the labor market attachment of older workers by increasing employment (Figure 3). Second, we assess potential public cost savings in terms of higher tax revenue and social insurance contributions by looking at labor earnings (Figure 4), and in terms of lower unemployment insurance payments by looking at unemployment (Figure 5). As discussed above, the latter is also informative about exits from the labor market via unemployment. We also investigate whether PWE reduces or increases the total time spent out of the labor force (Figure 6). This is informative about whether PWE leads to delayed exits from the labor market or instead encourages early exits as found by Machado and Portela (2012). Finally, we complete the picture by assessing whether workers spend more time with firms that offer PWE (Table 5).

Before we discuss the results in detail, we check the validity of our identification strategy by looking at the effects for the youngest age group, which should be unaffected by the introduction of PWE. Indeed, we find quantitatively negligible and usually statistically insignificant effects for all outcomes. Hence, for men, our identification strategy appears to have successfully removed selection bias associated with the introduction of PWE. In the following, we discuss the results for the oldest group of workers, which is directly affected by the introduction of PWE. The first thing to note is that there is interesting heterogeneity in the effects when we compare East and West Germany, despite similar utilization rates of PWE.

The main difference between the two parts of Germany is that labor market conditions are much more favorable in the West than in the East.

[[Figure 5.2 (Figure 3) near here]]

For older employees in East Germany, the introduction of PWE significantly increases employment and thus labor earnings while at the same time reducing unemployment. Employment rates increase significantly by five to six percentage points throughout the observation period, which corresponds to the utilization rate of PWE. Unemployment rates fall significantly and almost to the same extent by four to five percentage points throughout the observation period (see Table D.1 in Appendix D). In total, older workers in East German firms that offer PWE accumulate on average about seven months of employment (Figure 3) in the same firm (Table 5) and 8,000 euros more in labor earnings (Figure 4) than in firms without PWE while experiencing about six months less of unemployment (Figure 5). However, the cumulative time spent out of the labor force remains unaffected (Figure 6). Hence we find no evidence for undesired effects of PWE in terms of an increased number of early exits from the labor market for East Germany. Instead, we find that PWE reduces the number of exits through unemployment, which implies notable public cost savings through reduced unemployment insurance payments[23] and increased revenue though income taxes and social security contributions. There are no savings in terms of pension insurance payments, though, because the time when workers leave the labor market remains unaffected.

[[Figure 5.3 (Figure 4) near here]]

For West Germany, the picture is more diverse with interesting differences between older workers who use PWE shortly after its introduction and those who make use of this offer only later in the observation period (see the point-in-time estimates in Table D.1 in Appendix D). For the first group, the effects are similar to the ones for East Germany. During the first two years after the introduction of PWE we find significantly higher employment

[23] All workers in our sample qualify for unemployment insurance benefits because of the tenure requirement we impose for identification.

rates that correspond to the use rate of PWE, similar reductions in unemployment rates, and no effects on the share of workers out of the labor force. Three to four years after the introduction of PWE, however, positive employment effects and effects on unemployment quickly vanish while we start to see significantly positive effects on the share of workers out of the labor force. Hence from this point we find evidence for undesired effects of PWE in terms of an increased number of early exits from the labor market for West Germany.

[[Figure 5 (Figure 5) near here]]

[[Figure 6 (Figure 6) near here]]

In terms of cumulative effects, the differential effects for West German workers result in small positive but not significant effects on employment, a significant reduction in cumulated months unemployed of about four months—which does not increase further after four years—and a significant increase in the time out of the labor force of two months, which is reached after four years when there are no further effects on employment or unemployment. Table 5 additionally reveals that the differential effects in employment lead to no visible average effects on tenure in the firm. The effects on cumulated labor earnings in Figure 4 are positive and significant despite much smaller employment effects. The reason is that West German workers earn considerably more than East German workers (see Table 4).

[[Table 5.1 (Table 5) near here]]

As a last step, we look at potential spillover effects on middle-aged workers (41–50). Overall, we do not find any quantitatively important effects for this age group. Some very weak evidence, if any, suggests that East German firms increase employment of older workers by somewhat reducing employment of workers aged 41 to 50. The employment effects are not statistically significant, but there is a small significant increase in cumulated unemployment of about one month. Given an observation period of 6.5 years, this effect is, however, very small.

<H2>Cost-Benefit Considerations

On the basis of the estimated effects on cumulated earnings, unemployment, and time out of the labor force, it is possible to conduct a rough cost-benefit analysis from the perspective of the government. Several additional inputs and assumptions are required, however. They are summarized in Table 6. First, we use 40% to approximate average deductions for taxes and social insurance contributions, which is reasonable given the average gross earnings of workers in firms offering PWE reported in Table 4. Second, we need average monthly unemployment benefit payments. Because of the tenure requirement, all workers in our sample are eligible for UI. We assume that workers would have received UI during the entire estimated difference in months in unemployment. We approximate average monthly UI payments by applying the replacement rate of 60% to the average net earnings of workers in firms offering PWE. Third, we assume that the workers who were not employed at the end of the observation period after entering inactivity have entered the pension system. Hence, the difference in cumulated time out of the labor force is evaluated at the average monthly pension benefit for the share of workers who have not returned to employment. For the pension benefits, we apply a replacement rate of 55% to the average net earnings of workers in firms offering PWE. We chose a lower replacement rate than for UI because the workers will face penalties on their statutory pensions. Finally, we approximate expenditures on FEA-sponsored PWE by combining the average share of workers supported over the period 2002 to 2008, calculated from the numbers underlying Figure 1, with average expenditures per supported worker reported in Wanger (2009).

[[Table 5.2 (Table 6) near here]]

The results of these calculations are displayed in Table 7. We report costs, benefits, and net savings both without discounting and assuming a discount factor of 0.97 and 0.95 per annum to show how results change with different assumptions about discounting. We find that even with a discount factor of 0.95 there are net savings for the government: Over our

6.5-year observation period for outputs, the net gain per worker amounts to roughly 3,000 euros in West Germany and 4,800 euros in East Germany. Of course, these numbers are only rough approximations. They are sufficiently large, however, to make it reasonable to conclude that there is a net gain for the government.[24] Unfortunately, it is not possible to conduct a similar cost-benefit analysis for firms because the necessary inputs are unknown.

[[Table 5.3 (Table 7) near here]]

<H1>Conclusion

In this article, we assess the impact of firms' introduction of phased retirement schemes on their employees' labor market outcomes for Germany. These PWE schemes are available to workers aged 55 or older. Grogger and Wunsch (2013) showed that in the absence of attractive early retirement options, many older workers in Germany—both voluntarily and involuntarily—leave the labor market considerably before statutory retirement age (65) through unemployment, during which they claim unemployment insurance benefits. PWE has been introduced and supported by government subsidies with the aim of smoothing the transition from work to retirement and of decreasing costs in the public pension and unemployment insurance schemes through an increase in employment of elderly workers who otherwise would have exited prematurely through unemployment or early retirement. There is no legal requirement that firms offer PWE to their employees, but they may do so voluntarily.

Our results suggest that phased retirement options offered by firms can help to reduce some of the public costs associated with the premature exit of older workers from the labor market, mainly by reducing exits through unemployment. In line with the objectives of PWE, we find that its introduction increases employment and labor earnings and reduces unemployment of most older workers, while leaving the time of complete withdrawal from the labor market largely unchanged. Hence, the program benefits the government budget in terms

[24] It nevertheless needs to be borne in mind that because of our empirical design, we consider a sample of firms that potentially differ from companies that had already adopted PWE prior to 2000 in terms of factors that could be relevant for the costs and benefits.

of increased tax revenue and social insurance contributions as well as reduced unemployment insurance payments. A rough cost-benefit analysis suggests average net savings in public costs per worker in PWE of about 3,000 to 4,500 euros in West Germany and 4,500 to 7,000 euros in East Germany.

There may also be some undesired effects, however. We find evidence that the availability of PWE encourages some West German but not East German workers to exit the labor market earlier than they would without PWE. The main difference between the two parts of Germany is that labor market conditions are much more favorable in West than in East Germany. East German workers in our sample are more likely to experience interruptions in their work career and earn considerably less than West German workers. Hence, for a given age on average they have contributed less to the pension system and consequently have lower pension claims than their West German counterparts, which makes premature exit from the labor market less attractive for them. This suggests that the undesired effects documented by Machado and Portela (2012) are more likely when labor market conditions during the work life are better and when earnings and accumulated pension claims are higher. This is supported indirectly by the literature on the use of phased retirement, which shows higher use rates under these circumstances.

References

[[AU: For consistency with Journal style, please provide first names throughout.]]Abadie, A., and G. W. Imbens. 2006. Large sample properties of matching estimators for average treatment Effects. *Econometrica* 74: 235–67.[[AU: This style has now been applied for periodicals throughout.]]

<2M>. 2008. On the failure of the bootstrap for matching estimators. *Econometrica* 76: 1537–57.

Abraham, K. G., and S. N. Houseman. 2004. Work and retirement plans among older Americans. *Employment Research* 11(4): 1–4.

Biewen, M., B. Fitzenberger, R. Osikominu, and M. Paul. 2014. The effectiveness of public sponsored training revisited: The importance of data and methodological choices. *Journal of Labor Economics* 32:837–97.

BMAS. 2012. Alterssicherung in Deutschland: Zusammenfassender Bericht. Bundesministerium für Arbeit und Soziales, Forschungsbericht 431/Z.[[AU: What kind of publication is this? ANSWER: This is an official report of the federal ministry of labor and social issues]]

Börsch-Supan, A., and S. Jürges. 2011. Disability, pension reform and early retirement in Germany. NBER Working Paper No. 17079. Cambridge, MA: National Bureau of Economic Research.

Börsch-Supan, A., and C. Wilke. 2004. The German pension system: How it was, how it will be. NBER Working Paper No. 10525. Cambridge, MA: National Bureau of Economic Research.

Brussig, M., M. Knuth, and S. Wojtkowski. 2009. *Altersübergangs-Report*, 2009-02.[[AU: Is this a published or unpublished work? ANSWER: this is a non-peer reviewed "report" series]]

Dehejia, R. H., and S. Wahba. 2002. Propensity-score-matching methods for nonexperimental causal studies. *Review of Economics and Statistics* 84: 151–61.

Drago, R., M. Wooden, and D. Black. 2009. Who wants and gets flexibility? Changing work hours preferences and life events. *Industrial and Labor Relations Review* 62: 394–414.

Even, W. E., and D. A. Macpherson. 2004. Do pensions impede phased retirement? IZA Discussion Paper No. 1353, Bonn. [[AU: Place presented?]]

German Federal Employment Agency. 2012. Accessed at http://statistik.arbeitsagentur.de (July 2012)[[AU: Is this the access date? ANSWER: YES]].

German Pension Insurance Fund. 2012. Accessed at http://www.deutsche-rentenversicherung.de (July 2012).[[AU: Same queries as above ANSWER: YES]]

Grogger, J., and C. Wunsch. 2013. Unemployment insurance and departures from employment: Evidence from a German reform. Working Paper. Department of Economics, VU University Amsterdam.

Gustman, A. L., and T. L. Steinmeier. 1984. Partial retirement and the analysis of retirement behavior. *Industrial and Labor Relations Review* 37: 403–15.

Haider, S., and D. Loughran. 2001. Elderly labor supply: Work or play? Boston College CRR Working Paper No. 2001-04, Boston.

Honig, M., and G. Hanoch. 1985. Partial retirement as a separate mode of retirement behavior. *Journal of Human Resources* 20: 21–46.

Huber, M., M. Lechner, and C. Wunsch. 2013. The performance of estimators based on the propensity score. *Journal of Econometrics* 175: 1–21.

Hurd, M., and K. McGarry. 1993. The relationship between job characteristics and retirement. NBER Working Paper No. 4558. Cambridge, MA: National Bureau of Economic Research.

Hutchens, R. 2003. The Cornell study of employer phased retirement policies: A report on key findings. School of Industrial and Labor Relations, Cornell University, Ithaca, New York.

<2M>. 2010. Worker characteristics, job characteristics, and opportunities for phased retirement. *Labour Economics* 17: 1010–21.

Hutchens, R., and J. Chen. 2007. The role of employers in phased retirement: Opportunities for phased retirement among white-collar workers. ILR Collection Articles & Chapters Paper No. 48, Cornell University.

Hutchens, R., and K. Grace-Martin. 2006. Employer willingness to permit phased retirement: Why are some more willing than others? *Industrial and Labor Relations Review* 59: 525–46.

Inderbitzin, L., S. Staubli, and J. Zweimüller. 2013. Extended unemployment benefits and early retirement: Program complementarity and program substitution. IZA Discussion Paper No. 7330, Bonn.

Joffe, M. M., T. R. Have, H. I. Feldman, and S. Kimmel. 2004. Model selection, confounder control, and marginal structural models. *American Statistician* 58(4): 272–79.

Kim, H., and S. A. DeVaney. 2005. The selection of partial or full retirement by older workers. *Journal of Family and Economic Issues* 26: 371–94.

Lechner, M., R. Miquel, and C. Wunsch. 2011. Long-run effects of public sector sponsored training in West Germany. *Journal of the European Economic Association* 9: 742–84.

Lechner, M., and C. Wunsch. 2013. Sensitivity of matching-based program evaluations to the availability of control variables. *Labour Economics* 21: 111–21.

Machado, C. S., and M. Portela. 2012. Hours of work and retirement behavior. IZA Discussion Paper No. 6270, Bonn.

MacKinnon, J. G. 2006. Bootstrap methods in econometrics. *Economic Record* 82: 2–18.

[OECD] Organisation for Economic Co-operation and Development. 2009. *Live Longer, Work Longer*. Paris: OECD.

Robinson, C., and R. Clark. 2010. Retiree health insurance and disengagement from a career job. *Journal of Labor Research* 31: 247–62.

Rosenbaum, P. R., and D. B. Rubin .1983. The central role of the propensity score in observational studies for causal effects. *Biometrika* 70: 41–50.

Rubin, D. B. 1979. Using multivariate matched sampling and regression adjustment to control bias in observational studies. *Journal of the American Statistical Association* 74: 318–28.

Ruhm, C. J. 1990. Bridge jobs and partial retirement. *Journal of Labor Economics* 8: 482–501.

Staubli, S. 2011. The impact of stricter criteria for disability insurance on labor force participation. *Journal of Public Economics* 95(9–10): 1223–35.

Staubli, S., and J. Zweimüller. 2013. Does raising the early retirement age increase employment of older workers? *Journal of Public Economics* 108: 17–32.

Wanger, S. 2009. Altersteilzeit- Beliebt, aber nicht zukunftsgerecht. *IAB Kurzbericht*, 8-2009, 1–12, Nuremberg.

Wunsch, C. 2013. Optimal use of labor market policies: The role of job search assistance. *Review of Economics and Statistics* 95: 1030–45.

Wunsch, C., and M. Lechner. 2008. What did all the money do? On the general ineffectiveness of recent West German labour market programmes. *Kyklos* 61: 134–74.

[[In-text tables]]

Table 1. Number of Firms and Male Employees

	West			East		
Age	31–40	41–50	51–60	31–40	41–50	51–60
Firms	179	178	176	166	167	171
Individuals	4,098	4,269	3,390	4,145	4,894	2,902

Table 3.2.[[Table 2]] Summary of Potential Confounders and Control Variables Available in the Data

Potential confounders	Variables available in the data	Variables included in the estimation
Firm size	Firm size	Firm size
Industry of the firm	Industry of the firm	Industry of the firm
Occupation of the employees	Occupation of the employees	Occupation of the employees
Firm performance	Revenue, change in revenue compared with previous year, investments, firm growth, turnover	Share of employees leaving the firm
Restructuring activities, organizational factors, and human resource policies	Dozens of variables	Indicators for whether firm is currently restructuring, foreign ownership, single branch firm, looking for staff in the future, hiring skilled/young workers is a problem, staff shortage is a problem
Flexible work schedules	Working time accounts, job sharing, job rotation, share of part-time workers, employee works part-time	Firm uses working time accounts, employee works part-time
Tenure	Distribution of tenure in the firm, workers' tenure	Workers' tenure
Strong worker representation	Indicators for whether firm has works council, is subject to sectoral or firm-specific wage contract, follows sectoral wage contract, or is not subject to a wage contract	Indicator for whether firm ties pay to collective wage agreement
Region and its economic situation	Region dummies, unemployment rate, migration, commuting, dummies for urban and rural areas, population density, GDP growth, jobs per inhabitant aged 15–64, earnings per capita	Region dummies, rural/urban dummies, local unemployment rate
Composition of the firm's workforce/ individual characteristics of employees	Gender, age, education, nationality, part-time/full-time, earnings distribution, occupations, blue-collar/white-collar job	Gender, age, education, foreigner status, part-time/full-time, earnings, occupation
Health problems of the firm's workforce	Firm has problems with high absenteeism, share of employment contracts in the last 1–10 years that ended because of prolonged illness of more than six weeks	Firm has problems with high absenteeism

Employees‘ financial situation	Current wage, cumulated earnings during past 10 years, firm offers profit sharing	Current wage, cumulated earnings during past 10 years
Corporate pension plans	Industry of the firm, occupation of the employees, individual tenure and earnings, turnover, distribution of tenure and earnings in firm	Industry of the firm, occupation of the employees, individual tenure and earnings, share of employees leaving the firm, mean earnings in firm
Other factors and differential trends	More than 200 variables with half-yearly measurements of different types of employment, unemployment, receipt of unemployment insurance, wage earnings, program participation and inactivity; average duration and number of spells of employment/unemployment/program participation/inactivity, over the last 10 years	Tenure, cumulated earnings during past 10 years, unemployed in last 4/10 years, out of the labor force in last 4/10 years, fraction employed 9 to 10 years before

Notes: All variables that are available in the data but are not used in the estimation have been tested in omitted variable tests. They are highly correlated with the included variables and therefore do not add much explanatory power.

Table 3. [[Table 3]]Mean Characteristics of Firms Employing Elderly Male Workers by Region

	West				East			
	PWE		Difference		PWE		Difference	
	No	Yes	Unmatched	Matched	No	Yes	Unmatched	Matched
Basic firm characteristics								
Number of employees	284	354	70	9	252	302	50	0
Share of newly hired employees	0.13	0.11	–0.02	0.00	0.12	0.09	–0.03	–0.03
Share of employees leaving the firm	0.28	0.29	0.01	0.00	0.17	0.15	–0.02	0.01
Mean age of employees	40	40	0	1	41	40	–1	0
Share of employees 55 or older	0.14	0.13	–0.01	0.01	0.13	0.12	–0.01	0.00
Mean of monthly earnings in 1000s of euros	2.44	2.68	0.24	0.19	1.88	2.18	0.3	0.08
Human capital								
Share of apprentices	0.03	0.05	0.02	0.03	0.05	0.05	0.00	0.00
Share of unskilled workers	0.28	0.29	0.01	0.01	0.17	0.15	–0.02	0.00
Share of skilled workers	0.30	0.27	–0.03	–0.04	0.41	0.45	0.04	0.02
Share of clerks	0.29	0.33	0.04	0.09	0.29	0.28	–0.01	–0.05
Share of employees without vocational degree	0.26	0.27	0.01	0.02	0.1	0.08	–0.02	–0.01
Share of employees with vocational degree	0.61	0.64	0.03	0.06	0.74	0.75	0.01	0.05
Share of college/university graduates	0.05	0.07	0.02	0.02	0.11	0.15	0.04	0.00
Industry								
Manufacturing	0.66	0.88	0.22	0.03	0.59	0.78	0.19	0.02
Construction	0.13	0.01	–0.12	-0.07	0.00	0.00	0.00	0.00
Trade/sales/retail	0.08	0.06	–0.02	0.08	0.06	0.08	0.02	0.02
Service industry	0.14	0.05	–0.09	–0.04	0.35	0.14	-0.21	-0.05
Organization								
Foreign ownership >50%	0.37	0.14	-0.23	-0.14	0.13	0.04	-0.09	0.02
No working-time accounts	0.21	0.25	0.04	–0.03	0.25	0.19	–0.06	0.11

Profit sharing	0.16	0.24	0.08	–0.01	0.07	0.17	0.10	0.05
Pay tied to collective agreement	0.24	0.11	–0.13	–0.07	0.20	0.18	–0.02	–0.14
Recent reorganization of corporate structure	0.33	0.55	0.22	0.03	0.44	0.27	–0.17	–0.23
Staff-related issues								
Looking for staff right now	0.60	0.67	0.07	0.13	0.27	0.45	0.18	0.01
Hard to find skilled workers	0.59	0.67	0.08	0.08	0.42	0.53	0.11	0.15
High rate of absences	0.38	0.21	-0.17	0.03	0.22	0.25	0.03	0.11
Firm performance								
Firm growth	–13.7	–0.4	13.3	5.9	3.6	–1.5	-5.1	–9.0
Revenue increased compared with last year	0.45	0.52	0.07	0.04	0.30	0.42	0.12	–0.01
Share of capital widening investments	0.24	0.32	0.08	0.02	0.28	0.46	0.18	0.11
Regional characteristics								
Firm in city	0.38	0.29	–0.09	0.05	0.19	0.11	–0.08	–0.02
Mean unemployment rate 2002	8.4	8.4	0.00	-0.01	13.6	15.0	1.4	1.47
Number of observations	1167	2223			1365	1537		

Notes: All variables are measured in 2000 or relative to June 30, 2000. None of the differences are statistically significant at the 10% level.

Table 4. [[Table 4]]Mean Characteristics of Elderly Male Workers by Region

	West				East			
	PWE		Difference		PWE		Difference	
	No	Yes	Unmatched	Matched	No	Yes	Unmatched	Matched
Age	55	55	0	0	56	55	0	0
No vocational degree	0.18	0.20	0.02	0.00	0.05	0.04	–0.01	0.02
Vocational degree	0.68	0.71	0.03	0.02	0.72	0.72	0.00	-0.02
College/university degree	0.06	0.05	–0.01	0.01	0.19	0.23	0.04	0.02
Share employed in last 10 years	1.00	1.00	0.00	0.00	0.85	0.88	0.03	-0.01
Share unemployed in last 10 years*	0.00	0.00	0.00	0.00	0.02	0.01	–0.01	0.00
Share out of labor force in last 10 years*	0.00	0.00	0.00	0.00	0.13	0.11	–0.02	0.01
Gross earnings per month	3060	3240	180	–50	2180	2480	300	60
Unskilled worker	0.24	0.26	0.02	–0.01	0.16	0.13	–0.03	0.04
Skilled worker	0.39	0.34	–0.05	0.07	0.50	0.53	0.03	–0.03
Clerk	0.37	0.40	0.03	–0.06	0.34	0.34	0.00	0.00
Job in engineering	0.30	0.33	0.03	0.11	0.27	0.36	0.09	0.02
Job in construction**	0.09	0.03	–0.06	–0.03	0.00	0.00	0.00	0.00
Job in manufacturing	0.15	0.26	0.11	–0.11	0.16	0.21	0.05	-0.03
High-skilled job in services	0.27	0.24	–0.03	–0.01	0.28	0.22	–0.06	0.00
Low-skilled job in services	0.09	0.07	-0.02	0.02	0.18	0.12	–0.06	0.00
Other job	0.10	0.08	–0.02	0.01	0.10	0.06	–0.04	0.00
No German citizenship**	0.12	0.14	0.02	0.00	0.00	0.00	0.00	0.00
Number of observations	1167	2223			1365	1537		

Notes: All variables are measured in 2000 or relative to June 30, 2000. Observations with a non-zero value have been excluded for *men in West Germany and **East German workers. None of the differences are statistically significant at the 10% level.

Table 5. [[Table 5]]ATE on Tenure in the Original Establishment in Days (Men)

Region	Age	Effect	*P*-value in %
West	31–40	–91	72
	41–50	–147	56
	51–60	–40	82
East	31–40	–101	40
	41–50	–106	41
	51–60	224	14

Notes: */**/*** indicates significance at the 10/5/1% level. Inference is based on block bootstrapping p-values (clustered at the establishment level, 499 replications). Tenure refers to the time with the establishment after treatment measured from July 2004. Tenure before that is a control variable.

Table 6. [[Table 6]]Inputs for Cost-Benefit Analysis (Men)

	West	East
Difference in cumulated gross earnings	8,009	8,124
Difference in cumulated net earnings	4,806	4,874
Difference in months unemployed	–4.7	–5.7
Average monthly unemployment benefits	1,166	893
Difference in months out of the labor force	1.9	–1.6
Share not returning to employment after inactivity in %	12.0	9.3
Average monthly pension benefits	1,069	818
Share in FEA sponsored PWE in %*	18.5	18.5
Average expenditures on FEA sponsored workers*	12,203	12,203

Notes: Deductions for taxes and social insurance contributions 40%, average wages of workers in firms with PWE from Table 4, replacement rate for pensions 0.55.

* From Wanger 2009; separate numbers for East and West Germany are not available.

Table 7. [[Table 7]]Cost-Benefit Analysis (Men)

Discount factor	No discounting		0.97		0.95	
Region	West	East	West	East	West	East
Gain in tax revenue and social insurance contributions	3,204	3,249	2628	2666	2156	2187
Savings in unemployment benefits	5,469	5,052	4,487	4145	3681	3400
Savings in pension benefits	-1,769	1,184	1,451	–972	1,191	–797
Total average savings per worker over 6.5 years	6,904	9,486	5,664	7782	4646	6384
Total average expenditures per worker	2,253	2,253	1848	1848	1614	1614
Net savings per worker over 6.5 years	4,651	7,233	3,816	5934	3,032	4770

Appendix A

Descriptive Statistics for Different Samples

Table A.1 Means of Selected Variables for Different Samples (Men)

	(1) In EP 2000	(2) In EP 2002	(3) No PWE 99/00	(4) Final workers	(5) Final firms
Firm characteristics					
Number of employees	1,406	1,605	699	778	373
Share of newly hired employees	0.15	0.14	0.15	0.11	0.11
Share of employees leaving the firm	0.14	0.13	0.16	0.13	0.12
Mean age of employees	38.7	39.3	39.6	39.9	39.9
Share of employees 55 or older	0.11	0.11	0.11	0.11	0.11
Mean of monthly earnings in euros	2,611	2,654	2,256	2,420	2,305
Share of female employees	0.27	0.27	0.26	0.22	0.26
Share of employees w/o German citizenship	0.08	0.09	0.08	0.08	0.06
Share of part-time employees	0.10	0.10	0.09	0.05	0.06
Share of apprentices	0.04	0.04	0.04	0.04	0.05
Share of unskilled workers	0.24	0.24	0.26	0.27	0.25
Share of skilled workers	0.25	0.26	0.34	0.35	0.36
Share of clerks	0.36	0.35	0.27	0.28	0.29
Share of employees without vocational degree	0.20	0.20	0.20	0.21	0.17
Share of employees with vocational degree	0.64	0.65	0.65	0.66	0.70
Share of college/university graduates	0.11	0.11	0.08	0.09	0.09
Manufacturing sector	0.65	0.67	0.67	0.75	0.76
Construction sector	0.04	0.04	0.08	0.07	0.02
Trade/sales/retail sector	0.04	0.04	0.07	0.06	0.08
Service sector	0.25	0.25	0.18	0.12	0.14
Other sector	0.01	0.00	0.00	0.00	0.00
Individual characteristics					
Age	39.5	39.6	39.7	44.0	44.8
No vocational degree	0.19	0.18	0.19	0.16	0.11
Vocational degree	0.64	0.64	0.66	0.70	0.76
College/university degree	0.13	0.13	0.09	0.10	0.10
Share employed in last 10 years	0.80	0.82	0.78	0.92	0.93
Share unemployed in last 10 years	0.02	0.02	0.04	0.01	0.01
Share out of labor force in last 10 years	0.17	0.16	0.18	0.07	0.06
Gross earnings per month	2,816	2,832	2,367	2,736	2,688
Unskilled worker	0.24	0.25	0.26	0.27	0.23
Skilled worker	0.29	0.30	0.39	0.43	0.46
Clerk	0.37	0.36	0.25	0.29	0.30
Job in engineering	0.30	0.31	0.29	0.32	0.32
Job in construction	0.04	0.04	0.07	0.06	0.02
Job in manufacturing	0.21	0.22	0.22	0.25	0.24
High-skilled job in services	0.28	0.27	0.19	0.19	0.21
Low-skilled job in services	0.09	0.08	0.11	0.09	0.11
Other job	0.07	0.07	0.10	0.08	0.09
No German citizenship	0.09	0.09	0.08	0.08	0.06
Number of observations	837,137	602,153	92,320	52,043	23,698
Percentage of previous sample	100	72	15	56	46

Notes: (1) All employees of firms observed in the Establishment Panel (EP) for which we have linked employer-employee data. (2) Firms not observed in EP 2002 excluded. (3) Firms with PWE in 1999 or 2000 excluded. (4) Workers aged ≤ 30 or > 60 or with tenure < 3 years or from West Germany with share employed in last 10 years < 1 excluded. (5) Firms with > 1000 employees or in other sector or that neither have a collective wage agreement nor tie pay to collective agreements or from East Germany in construction sector excluded. All variables are measured in 2000 or relative to June 30, 2000.

Appendix B

Probit Specifications for Selection into PWE

Table B.1. Probit Specifications for Males in West Germany

	Aged 31–40		Aged 41–50		Aged 51–60	
	Coeffi-cient	P-value in %	Coeffi-cient	P-value in %	Coeffi-cient	P-value in %
Constant	–6.984	0.0	–7.211	0.0	–5.948	0.0
Firm characteristics						
Log number of employees	0.792	0.0	0.966	0.0	0.902	0.0
501–1,000 employees	-0.503	0.0	–0.818	0.0	–0.697	0.0
Share of employees 55 or older	2.203	0.0	1.323	0.4	0.233	67.1
Share of employees leaving the firm	–1.480	0.0	–1.403	0.0	–0.311	8.1
Share of unskilled employees	–0.387	0.1	–0.366	0.2	0.155	27.4
Single branch firm	0.326	0.0	0.319	0.0	0.222	0.0
High number of absences is a problem	–0.426	0.0	–0.522	0.0	–0.705	0.0
Staff shortage is problem	–0.333	0.0	–0.266	0.0	–0.458	0.0
No working-time accounts	0.000	99.3	0.192	0.0	0.310	0.0
Reorganization of corporate structure	0.617	0.0	0.615	0.0	0.543	0.0
Pay tied to collective agreement	–0.751	0.0	–0.656	0.0	–0.739	0.0
Manufacturing industry	0.439	0.0	0.508	0.0	0.564	0.0
Employee characteristics						
Age	0.006	49.0	0.001	85.0	0.001	89.1
No German citizen	0.289	0.1	–0.111	18.3	–0.014	86.8
University entrance degree (Abitur)	–0.216	3.4	–0.272	0.2	–0.258	1.1
No vocational degree	0.041	59.3	0.034	64.6	–0.019	82.7
Manufacturing occupation	0.226	0.0	0.231	0.0	0.407	0.0
Service occupation	0.153	3.8	0.025	70.9	0.138	3.5
Unskilled worker	0.249	0.1	0.383	0.0	0.291	0.1
Clerk	0.104	20.1	0.196	0.8	0.188	1.3
Half-monthly earnings in 1000s of euros	1.060	0.0	0.923	0.0	0.414	0.1
Half-monthly earnings > 1,500 euros[[AU: Confusing. In 1000s?]]	–0.476	0.0	–0.388	0.0	–0.069	47.8
Tenure	0.059	30.6	0.064	24.1	–0.007	92.3
Tenure 7 years	–0.192	12.9	–0.441	0.0	–0.428	0.8
Regional characteristics						
Big agglomeration	–0.653	0.0	–0.629	0.0	–0.650	0.0
Local unemployment rate	0.131	0.0	0.097	0.0	0.080	0.0
Northern Germany	–0.459	0.0	–0.345	0.2	–0.577	0.0
Central Germany	–0.150	0.8	–0.102	7.3	–0.146	3.1
Number of individual observations	4,098		4,269		3,390	
Efron's R^2	0.26		0.28		0.28	

Note: All variables are measured in 2000 or relative to June 30, 2000.

Table B.2. Probit Specifications for Males in East Germany

	Aged 31–40		Aged 41–50		Aged 51–60	
	Coeffi-cient	*P*-value in %	Coeffi-cient	*P*-value in %	Coeffi-cient	*P*-value in %
Constant	–3.275	0.0	–1.277	0.7	–2.279	0.1
Firm characteristics						
Log number of employees	0.155	0.1	0.029	51.9	0.138	1.1
Share of employees with university or college degree	4.167	0.0	4.554	0.0	3.019	0.0
Share of employees 55 or older	–0.670	13.0	0.033	93.7	1.946	0.0
No working-time accounts	0.178	0.4	0.280	0.0	0.065	45.5
Share of employees leaving the firm (survey)	–7.419	0.0	-9.973	0.0	– 10.950	0.0
No reorganization	0.002	97.7	-0.035	59.8	-0.307	0.0
Looking for staff in future	0.833	0.0	1.071	0.0	1.047	0.0
Hiring skilled workers is problem	0.365	0.0	0.157	0.9	0.164	3.6
Hiring young workers is problem	–0.525	0.0	–0.472	0.0	–0.863	0.0
High number of absences is a problem	0.671	0.0	0.681	0.0	0.560	0.0
Foreign-owned to more than 50%	–0.491	0.0	–0.551	0.0	–0.930	0.0
Trade sector	0.964	0.0	1.097	0.0	0.767	0.0
Service sector	–0.531	0.0	–0.518	0.0	–0.633	0.0
Employee characteristics						
Age	–0.003	71.0	–0.027	0.1	–0.009	37.7
University entrance degree (Abitur)	–0.121	48.1	–0.169	21.1	0.232	22.1
Vocational degree	0.392	0.0	0.139	14.5	0.136	25.3
University or college degree	0.427	4.8	0.312	6.3	–0.099	68.1
Technical occupation	–0.453	0.0	–0.382	0.0	–0.142	8.8
Higher-skilled service occupation	–0.602	0.0	–0.578	0.0	–0.343	0.1
Low-skilled service occupation	0.075	44.7	–0.135	13.6	–0.084	45.0
Other occupation	–0.403	0.0	–0.451	0.0	–0.361	0.3
Skilled worker	–0.378	0.0	–0.301	0.0	–0.116	22.3
Clerk	–0.284	0.8	–0.360	0.1	–0.261	4.9
Half-monthly earnings in euros	1.118	0.0	1.562	0.0	0.265	20.6
Half-monthly earnings > 1,500 euros	–0.209	8.8	–0.415	0.0	–0.037	76.1
Cumulated earnings from employment in last 10 years	–0.131	25.4	–0.298	2.3	0.105	40.7
Tenure	0.517	0.0	0.523	0.0	0.530	0.0
Tenure 7 years	–0.713	0.0	–0.854	0.0	–0.766	0.0
Unemployed in last 4 years	–0.344	1.0	–0.645	0.0	–0.583	2.6
Unemployed in last 10 years	–0.085	19.5	-0.203	0.2	–0.004	96.8
Out of the labor force in last 4 years	–0.021	82.4	–0.026	77.4	–0.002	98.8
Out of the labor force in last 10 years	0.320	0.0	0.177	0.1	0.113	10.9
Fraction employed 9–10 years before	1.015	0.0	1.014	0.0	1.257	0.0
Regional characteristics						
Rural area	0.271	0.0	0.395	0.0	0.390	0.0
Number of individual observations	4,145		4,894		2,902	
Pseudo R^2	0.22		0.26		0.26	

Note: All variables are measured in 2000 or relative to June 30, 2000.

Appendix C

Common Support

Table C.1. Loss of Observations Due to Imposition of Common Support

	West			East		
Stratum	31–40	41–50	51–60	31–40	41–50	51–60
All observations	4,098	4,269	3,390	4,145	4,894	2,902
Percentage remaining	93	97	94	87	91	95

Table C.2. Means of Variables before and after Imposing Common Support (Men Aged 51–60)

	West			East		
	All	Remaining	Excluded	All	Remaining	Excluded
Basic firm characteristics						
Number of employees	386	377	520	336	339	296
Share of newly hired employees	0.12	0.12	0.12	0.10	0.10	0.26
Share of employees leaving the firm	0.14	0.14	0.08	0.11	0.10	0.24
Mean age of employees	40.0	40.0	40.1	40.9	40.8	42.6
Share of employees 55 or older	0.13	0.13	0.11	0.13	0.13	0.17
Mean of monthly earnings in euros	2,593	2,584	2,727	2,032	2,053	1,653
Share of female employees	0.23	0.23	0.13	0.30	0.30	0.28
Share of employees w/o German citizenship	0.13	0.13	0.09	0.00	0.00	0.00
Share of part-time employees	0.07	0.07	0.06	0.07	0.06	0.14
Human capital						
Share of apprentices	0.05	0.05	0.03	0.05	0.05	0.02
Share of unskilled workers	0.29	0.29	0.26	0.16	0.15	0.31
Share of skilled workers	0.28	0.28	0.38	0.43	0.44	0.24
Share of clerks	0.31	0.32	0.27	0.29	0.29	0.29
Share of employees without vocational degree	0.26	0.27	0.20	0.09	0.09	0.06
Share of employees with vocational degree	0.63	0.62	0.74	0.74	0.74	0.75
Share of college/university graduates	0.06	0.06	0.05	0.13	0.13	0.17
Industry						
Manufacturing	0.80	0.79	1.00	0.69	0.70	0.49
Construction	0.05	0.05	0.00	0.00	0.00	0.00
Trade/sales/retail	0.07	0.07	0.00	0.07	0.07	0.07
Service industry	0.08	0.09	0.00	0.24	0.23	0.44

Organization						
Foreign ownership >50%	0.22	0.23	0.12	0.08	0.09	0.01
No working-time accounts	0.23	0.22	0.40	0.22	0.20	0.44
Profit sharing	0.21	0.19	0.48	0.12	0.12	0.14
Pay tied to collective agreement	0.16	0.17	0.00	0.19	0.17	0.38
Recent reorganization of corporate structure	0.48	0.45	0.88	0.35	0.36	0.19
Staff-related issues						
Looking for staff right now	0.64	0.66	0.48	0.36	0.36	0.49
Hard to find skilled workers	0.64	0.64	0.60	0.48	0.47	0.54
High rate of absences	0.27	0.28	0.08	0.23	0.23	0.32
Firm performance						
Firm growth	–5.0	–5.5	3.8	0.9	0.0	17.0
Revenue increased compared with last year	0.49	0.48	0.62	0.36	0.36	0.46
Share of capital widening investments	0.29	0.29	0.29	0.38	0.38	0.26

.

Table C.2. Continued.

	West			East		
	All	Remaining	Excluded	All	Remaining	Excluded
Regional characteristics						
Firm in city	0.32	0.33	0.15	0.15	0.14	0.28
Mean unemployment rate 2002	8.39	8.30	9.74	14.33	14.22	16.22
Individual characteristics						
Age	55.2	55.2	54.9	55.3	55.4	55.1
No vocational degree	0.19	0.20	0.15	0.04	0.04	0.03
Vocational degree	0.70	0.70	0.83	0.72	0.72	0.71
College/university degree	0.05	0.05	0.01	0.21	0.21	0.25
Share employed in last 10 years	1.00	1.00	1.00	0.86	0.86	0.86
Share unemployed in last 10 years*	0.00	0.00	0.00	0.01	0.01	0.03
Share out of labor force in last 10 years*	0.00	0.00	0.00	0.12	0.12	0.10
Gross earnings per month	3180	3173	3283	2345	2360	2068
Unskilled worker	0.25	0.25	0.27	0.15	0.14	0.34
Skilled worker	0.36	0.36	0.31	0.51	0.53	0.28
Clerk	0.39	0.39	0.41	0.34	0.34	0.38
Job in engineering	0.32	0.32	0.29	0.32	0.32	0.21
Job in construction**	0.05	0.05	0.03	0.00	0.00	0.00
Job in manufacturing	0.22	0.21	0.37	0.19	0.19	0.12
High-skilled job in services	0.25	0.25	0.23	0.25	0.25	0.23
Low-skilled job in services	0.08	0.08	0.07	0.15	0.14	0.37
Other job	0.09	0.09	0.01	0.08	0.08	0.07
No German citizenship**	0.13	0.13	0.13	0.00	0.00	0.01
Number of observations	3390	3177	213	2902	2746	156

Percentage remaining within support	94	95

Notes: All variables are measured in 2000 or relative to June 30, 2000. Observations with a non-zero value have been excluded for *men in West Germany and **East German workers.

Appendix D

Further Estimation Results

Table D.1. Point-in-Time Estimates (Men)

		West Germany						East Germany					
		Age 31–40		Age 41–50		Age 51–60		Age 31–40		Age 41–50		Age 51–60	
		Effect	*P*-value	Effect	*P*-value	Effect	*P*-value	Effect	*P*-value	Effect	*P*-value	Effect	*P*-value
In PWE end of	12/02	.0000		.0000		.0589	.00	.0000		.0000		.0564	.00
	06/03	.0000		.0000		.0549	.00	.0000		.0000		.0603	.00
	12/03	.0000		.0000		.0539	.00	.0000		.0000		.0647	.00
	06/04	.0000		.0000		.0601	.00	.0000		.0000		.0633	.01
	12/04	.0000		.0003	.21	.0594	.00	.0000		.0003	.23	.0655	.01
	06/05	.0000		.0003	.21	.0582	.00	.0000		.0007	.24	.0628	.01
	12/05	.0000		.0005	.13	.0625	.00	.0000		.0015	.30	.0616	.01
	06/06	.0000		.0014	.06	.0585	.00	.0000		.0021	.25	.0561	.01
	12/06	.0000		.0027	.03	.0570	.00	.0000		.0023	.33	.0552	.01
	06/07	.0000		.0059	.01	.0504	.00	.0000		.0038	.29	.0488	.01
	12/07	.0000		.0090	.00	.0431	.00	.0000		.0059	.25	.0512	.01
	06/08	.0000		.0103	.03	.0374	.01	.0000		.0063	.24	.0478	.01
	12/08	.0000		.0120	.02	.0337	.02	.0000		.0079	.22	.0477	.00
Employed end of	12/02	.0016	.38	–.0010	.47	.0031	.43	.0019	.35	–.0121	.10	.0605	.01
	06/03	–.0057	.19	.0092	.23	.0515	.10	.0024	.31	–.0108	.12	.0536	.01
	12/03	–.0124	.17	.0093	.25	.0561	.06	.0063	.21	–.0103	.18	.0467	.03
	06/04	–.0050	.38	–.0035	.40	.0407	.13	.0039	.26	–.0090	.18	.0459	.04
	12/04	–.0012	.47	–.0015	.46	.0351	.17	.0068	.19	–.0095	.20	.0436	.05
	06/05	.0073	.24	–.0043	.38	.0205	.29	.0041	.31	-.0086	.25	.0403	.05
	12/05	.0079	.26	–.0158	.25	.0141	.34	.0035	.34	–.0133	.17	.0494	.04

Table D.1. Continued

		West Germany						East Germany					
		Age 31–40		Age 41–50		Age 51–60		Age 31–40		Age 41–50		Age 51–60	
		Effect	*P*-value	Effect	*P*-value	Effect	*P*-value	Effect	*P*-value	Effect	*P*-value	Effect	*P*-value
Out of labor force	12/05	–.0064	.23	.0094	.19	.0289	.17	–.0029	.22	.0019	.41	–.0144	.26
end of	06/06	–.0247	.13	.0090	.23	–.0086	.39	–.0022	.26	.0028	.37	–.0119	.30
	12/06	–.0014	.40	.0069	.31	–.0078	.40	–.0004	.45	.0042	.30	–.0133	.31
	06/07	.0042	.26	.0063	.35	–.0081	.40	–.0032	.25	.0004	.49	–.0113	.37
	12/07	–.0043	.27	.0082	.31	–.0025	.47	–.0034	.22	.0060	.29	–.0081	.39
	06/08	–.0009	.46	.0080	.31	–.0032	.45	–.0045	.19	.0040	.37	–.0054	.41
	12/08	–.0022	.40	.0030	.42	–.0044	.44	–.0010	.42	.0106	.21	–.0259	.18

Notes: Inference is based on block bootstrapping *p*-values (clustered at the establishment level, 499 replications).

Appendix E

Matching Protocol

Table E.1. A Matching Protocol for the Estimation of a Counterfactual Outcome and the Effects

Step A-1	Choose one observation in the subsample defined by treatment *d*=1 and delete it from that pool.
Step B-1	Find an observation in the subsample defined by *d*=0 that is as close as possible to the one chosen in step A-1 in terms of $p(x),\tilde{}$. "Closeness" is based on the Mahalanobis distance.
Step C-1	Repeat A-1 and B-1 until no observation with *d*=1 is left.
Step D-1	Compute the distribution of distances obtained for any comparison between a member of the reference distribution and matched comparison observations. Obtain the distance at quantile *Q* (*dist*).
Step A-2	Repeat A-1.
Step B-2	Repeat B-1. If possible, find other observations in the subsample of *d*=0 that are at least as close as *R* * *dist* to the one chosen in step A-2. Do not remove these observations, so that they can be used again. Compute weights for all chosen comparisons observations that are proportional to their distance. Normalize the weights such that they add to one.
Step C-2	Repeat A-2 and B-2 until no participant in *d*=1 is left.
Step D-2	For any potential comparison observation, add the weights obtained in A-2 and B-2.
Step E	Using the weights $w(x_i)$ obtained in D-2, run a weighted linear regression of the outcome variable on the variables used to define the distance (and an intercept.
Step F-1	Predict the potential outcome $y^0(x_i)$ of every observation using the coefficients of this regression: $\hat{y}^0(x_i)$.
Step F-2	Estimate the bias of the matching estimator for $E(Y^0 \mid D=1)$ as: $\sum_{i=1}^{N} \frac{d_i \hat{y}^0(x_i)}{N_1} - \frac{(1-d_i) w_i \hat{y}^0(x_i)}{N_0}$.
Step G	Using the weights obtained by weighted matching in D-2, compute a weighted mean of the outcome variables in *d=0*. Subtract the bias from this estimate to get $E(Y^0 \mid D=1)$.

The parameters used to define the radius for the distance-weighted radius matching are set to 0.9 for both, *R* and *Q*. *Q* refers to the quantile of the distribution of the distances to the closest neighbor in a one-to-one matching. It is defined in terms of the propensity score. Different values for *R* and *Q* are checked in the sensitivity analysis in Lechner, Miquel, and Wunsch (2011) as well as in the simulation study by Huber, Lechner, and Wunsch (2013). They showed a considerable robustness of the results with respect to the choice of *R* and *Q*.